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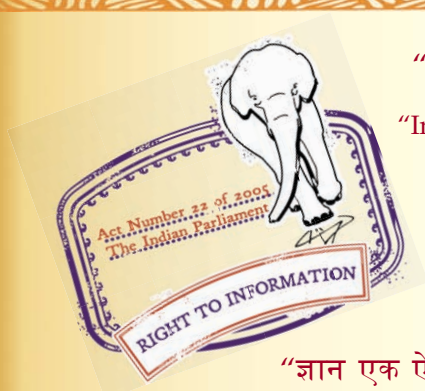
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SPECIFICATION FOR
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Indian Standard

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SPECIFICATION FOR EQUIPMENT FOR GRIT REMOVAL DEVICES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 24 September 1971, after the draft finalized by the Public Health Engineering Equipment Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Grit removing devices are located either before or after sewage pumps in sewage treatment plants to prevent clogging of pipelines, channels, etc, due to settlement of grit. They separate non-decaying heavy inorganic material from sewage so that inorganic material may be disposed off without causing nuisance. They also assist in prevention of grit accumulation in digestors and clarifiers, and in general in protecting all the machinery used in sewage treatment plant. This standard covers the requirements of equipment for grit removal.

0.3 There are no standard design criteria in the country and norms of operation for equipment for grit removal and guidance on this aspect is basically necessary for suiting the equipment to the scheme of sewage treatment as a whole. Certain recommendations have, therefore, been given in **0.3.1** to **0.3.9** for general guidance and to indicate the basis of the specification themselves. These design criteria will be reviewed when more data become available for the Sectional Committee's consideration.

0.3.1 All sewage treatment plants receiving an average sewage flow of 400 m³/h or more should preferably be provided with mechanical grit removal equipment.

0.3.2 Non-mechanical grit removal devices should have suitable standby arrangement. In case of mechanical grit removal devices also, suitable standby arrangement should be provided for larger plant, elsewhere, a manually operated device should be invariably provided as a standby.

0.3.3 Mechanically operated grit removing devices may be either continuously operating type or intermittently operated type.

0.3.4 Grit removal devices shall be capable of removing from sewage grit particles of minimum specified size and above. Unless otherwise specified, it is recommended that they shall be designed for the removal of particles of 0.15 mm size and above.

0.3.5 Grit removal devices shall be designed for the removal of grit particles of specified specific gravity. It is always desirable to determine from actual testing the specific gravity of grit particles as it may vary substantially. Unless otherwise specified, it is recommended that they should be designed for removal of particles of specific gravity 2.3.

0.3.6 Grit removal devices shall be designed taking into account the temperature of sewage as it exists, during the average winter period.

0.3.7 Surface areas of all grit removal devices shall be designed for peak flow and for the size and specific gravity of particles designed to be removed and the temperature. Guidance is given in Appendix A. The maximum velocity of flow in grit chamber is dependent on size and specific gravity of particle proposed to be removed and normally should not exceed 0.17 m/s for a particle size of 1.5 mm and of specific gravity 2.3.

0.3.8 Grit removal devices may be in the form of constant velocity channels or square tanks with or without mechanical grit removal devices.

0.3.9 All grit removal devices shall be designed to handle the expected maximum volume of grit in sewage. Average grit volume of 0.025 to 0.075 m³/1 000 m³ of sewage have been recorded, with peak loads of 0.3 m³/1 000 m³ of sewage flow lasting for an hour or two.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements for grit removal devices used in sewage treatment plants for domestic as well as municipal sewages, the latter often containing a variety of industrial wastes.

1.2 This standard shall also be applicable to wholly industrial wastes where grit removal devices are intended to be used.

1.3 This standard does not cover aerated grit chambers since they are not in common use at present in India.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

*Rules for rounding off numerical values (*revised*). —

2.1 Intermittent Type Mechanical Grit Removal Devices — Devices in which grit settled at the bottom of the collecting tank is removed intermittently by means of mechanical device like grab, bucket, travelling scraper or similar equipment.

2.2 Continuous Grit Removal Devices — Devices in which grit collected at the bottom of the tank is continuously removed by mechanical equipment, such as rotating or reciprocating scrapers, screws, plows, pumps or similar devices, without allowing accumulation of grit at the bottom of the collecting tank.

2.3 Grit Washing Equipment — Devices provided in all intermittent or continuous grit removing units for washing the grit free of organic matter prior to its disposal.

2.4 Velocity Control Devices — Devices intended to control the velocity obtaining in grit removal channels over varying rates of flow through the channel; such devices may be in the form of proportional flow weirs or other weir or flumes. The loss of head through the grit removal devices is affected by the choice of velocity control device.

3. MATERIAL

3.1 The materials used for component parts are given in Table 1.

4. CONSTRUCTION

4.1 General — All grit chambers shall be provided with facilities for uniform distribution of sewage at entry and exit so as to make full and efficient use of the chamber.

4.2 Continuous Mechanical Grit Removal Devices

4.2.1 Continuous mechanical grit removal devices shall be designed to remove grit settled in the grit collection tanks continuously without allowing accumulation of grit in the tanks. Rotating scrap ploughs may be employed for this purpose.

4.2.2 Mechanical grit removal devices shall be provided with electrical or mechanical devices which shall automatically cut out the motor in case the unit is overloaded due to sudden grit load, unusual obstruction or jamming of equipment or some other cause.

4.2.3 Where necessary, provision should be made for adequate ventilation and lighting. The lamps should be of low voltage and/or of flame-proof type. Ventilation should be of the forced type which may be provided by blowers located at ground level with suitable flexible ducting to displace out air swiftly from the grit removal devices.

**TABLE 1 MATERIALS OF CONSTRUCTION FOR GRIT
REMOVAL DEVICES**

(Clause 3.1)

SL No.	PARTICULARS	MATERIAL	REF TO INDIAN STANDARD
i)	Civil works	a) Reinforced or plain concrete b) Brick masonry c) Stone masonry	IS : 456-1964 ¹ IS : 2212-1962 ² IS : 1597(Part I)-1967 ³ IS : 1597(Part II)-1967 ⁴
ii)	Motors, starters, time switches and electrode switches	—	IS : 325-1970 ⁵ IS : 996-1964 ⁶ IS : 1766-1961 ⁷ IS : 1822-1967 ⁸
iii)	Turn table	High grade cast iron	IS : 210-1970 ⁹
iv)	Reduction gear	Steel or any other material	IS : 1570-1961 ¹⁰ IS : 1871-1965 ¹¹
v)	Gates	Cast iron steel	IS : 3042-1965 ¹² IS : 226-1969 ¹³
vi)	Scrapers (fabricated sheets)	—	IS : 513-1963 ¹⁴
vii)	Shaft	Cold finished steel	IS : 1570-1961 ¹⁰
viii)	Floats	Plastic (polyethylene, PVC, glass fibre reinforced polyester)	—
x)	Channels	Steel	IS : 3954-1964 ¹⁵

¹Code of practice for plain and reinforced concrete (*second revision*).

²Code of practice for brickwork.

³Code of practice for construction of stone masonry: Part I Rubble stone masonry.

⁴Code of practice for construction of stone masonry: Part II Ashlar masonry.

⁵Three-phase induction motors (*third revision*).

⁶Single-phase small ac and universal electric motors (*revised*).

⁷Specification for time switches.

⁸Specification for ac motor starters of voltage not exceeding 1 000 volts (*first revision*).

⁹Specification for grey iron castings (*second revision*).

¹⁰Schedules for wrought steels for general engineering purposes.

¹¹Commentary on Indian Standard wrought steels for general engineering purposes.

¹²Specification for single faced sluice gates (200 to 1 200 mm size).

¹³Specification for structural steel (standard quality) (*fourth revision*).

¹⁴Specification for cold rolled carbon steel sheets (*revised*).

¹⁵Specification for hot-rolled steel channel sections for general engineering purposes.

4.2.4 Continuous grit removal devices, installed in deep pits may be provided with mechanical devices, such as bucket elevator for lifting grit to the surface.

4.2.5 Continuous grit removal devices installed in deep pits shall be such that the equipment could be lifted to ground level for repairs and maintenance.

4.2.6 A walkway/staircase/ladder shall be provided to permit convenient and safe access to all parts of the equipment. The walkway/staircase/ladder shall not be less than 90 cm wide and shall be provided with hand rail on both sides. The walkway shall be made of chequered plates or steel gratings of approved design.

4.2.7 The motors shall be provided with magnetic starters suitable for outdoor mounting.

4.2.8 The turn table (wherever used) or drive units shall be preferably of oil immersed type with bearings and weather proof protection. The assembly of the units shall be such as to provide easily accessible points of lubrication. An overload alarm, audible and visible, shall be provided.

4.2.9 All bearings and similar parts requiring lubrication and maintenance and all wearing parts shall be located as far as possible above the water level for easy maintenance without interrupting operation and to eliminate abrasive action of grit; where the bearings are likely to be immersed they should be protected against ingress of grit.

4.3 Intermittent Type Mechanical Grit Removal Device

4.3.1 Where intermittent removal of grit is envisaged, sufficient storage space for settled grit shall be provided in such a manner as not to affect the velocity through the grit chamber. The storage space would be governed by the proposed frequency of grit removal operation.

4.3.2 The frequency of removing grit settled in the grit collection tanks shall be such that organic matter settled with grit shall not cause nuisance by decomposition. It is recommended that this frequency shall not be less than once in 8 hours.

4.3.3 Intermittent grit removal devices installed in deep pits may be provided with mechanical devices, such as bucket elevator for lifting grit to the surface.

4.3.4 Intermittent grit removal devices installed in deep pits shall be such that the equipment could be lifted to the ground level for repair and maintenance.

4.3.5 A walkway/staircase/ladder shall be provided to permit convenient and safe access to all parts of the equipment. The walkway/staircase/ladder shall not be less than 90 cm wide and shall be provided with hand rail on both sides. The walkway shall be made of chequered plates or steel grating of approved design.

4.4 Grit Washing Equipment

4.4.1 Wherever mechanical grit removal devices, such as intermittent type or continuous type equipment are employed for removal of grit from grit collecting tanks, grit washing arrangements shall also be provided, unless the grit removed from the collecting tank meets the requirements of **4.4.2** without washing.

4.4.2 Grit cleaning device provided shall be such that washed grit shall not contain more than three percent by weight of organic matter.

4.4.3 These devices shall be provided with necessary arrangements for returning the organics to sewage flow at the inlet of the grit chamber.

4.4.4 These devices may be constructed for washing with either sewage itself or with fresh water.

4.4.5 The arrangement shall be basically agitation type devices, such as reciprocating rakes, screws, vortex separators or similar devices.

4.4.6 Grit discharged by washing equipment shall contain minimum amount of water so as to permit disposal of grit by trucks or similar devices. When grit discharged contains excessive water, facilities for draining of water shall be provided as part of grit cleaning device.

4.4.7 They shall be able to withstand the abrasive action of grit. All bearings, wearing parts, etc, of the equipment shall be preferably above water.

4.4.8 Motors, starters, drive units, drive and other mechanical parts pertaining to grit washing arrangement shall be similar to those used in the grit removal device.

APPENDIX A

(Clause 0.3.7)

GRIT REMOVAL DEVICES

A-1. DETAILS

A-1.1 The overflow rates for grit removal devices are given in Table 2 for guidance.

TABLE 2 OVERFLOW RATES FOR GRIT REMOVAL DEVICES

(Clause A-1.1)

SIZE OF GRIT PARTICLE (APPROXIMATE MESH SIZE)	DIA mm	THEORETICAL MAXIMUM PERMISSIBLE OVERFLOW RATE FOR SUBSTANTIALLY COMPLETE REMOVAL		
		sp gr 2.65 $\text{m}^3/\text{d}/\text{m}^2$	sp gr 2.3 $\text{m}^3/\text{d}/\text{m}^2$	sp gr 2.0 $\text{m}^3/\text{d}/\text{m}^2$
(1)	(2)	(3)	(4)	(5)
65	0.21	1 890	1 485	1 126
80	0.18	1 670	1 310	1 015
100	0.15	1 320	1 065	800

NOTE 1 — A scale factor would be necessary to arrive at values to be used in practice so as to take into account turbulence, short circuiting, etc.

NOTE 2 — The values are not substantially affected in the temperature range of sewage of 4.5°C to 26.5°C.

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